IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Kobby Pick et al.	Art Unit:	2611
Serial No.:	10/053,490	Examiner:	Phuong M. Phu
Filed:	October 26, 2001	Assignee:	Intel Corporation
Title:	METRIC CORRECTION FOR MULTI USER DETECTION, FOR LONG CODES DS-CDMA		

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SUPPLEMENTAL BRIEF ON APPEAL

Pursuant to the 37 C.F.R. § 41.31, M.P.E.P. § 1207.04, and the Notice of Appeal filed herewith, Applicant hereby files this Brief on Appeal to respond to the new grounds for rejection raised in the Office Action mailed April 27, 2006 and to respond to the Notification of Non-Compliant Appeal Brief mailed August 15, 2006.

(1) Real Party in Interest

This case is assigned of record to Intel Corporation.

(2) Related Appeals and Interferences

There are no known related appeals and/or interferences.

(3) Status of Claims

Claims 1-28 are pending. Claims 1, 9, 19, and 24 are in independent form. Claims 19-23 are allowed. Claims 2, 15, and 26 are objected to as dependent on a rejected independent claim. The rejections of claims 1-18 and 24-28 are appealed.

(4) Status of Amendments

In light of the Office Action mailed April 27, 2006 reopening prosecution, all claim amendments have been entered.

(5) Summary of Claimed Subject Matter

In direct sequence spread spectrum transmission, a stream of information is divided into small pieces, each of which is allocated across the spectrum to a different signature sequence over the same frequency channel. *See specification*, page 3, line 12-15. With multiple users, these allocations can become cross-correlated and the resulting interference is termed "multiple access interference (MAI)." *See specification*, page 3, line 20-page 4, line 2. The amount of multiple access interference can change from symbol to symbol during a direct sequence spread spectrum transmission. *See specification*, page 4, line 1-2. However, multiple access interference is only one contributor to the total noise that afflicts direct sequence spread spectrum transmissions. *See, e.g., specification*, page 6, line 9-11.

Independent claim 1 relates to a method of normalizing an output of a receiver. *See, e.g.*, FIG. 2 and the written description thereof. The method includes determining a normalization factor (*see, e.g.*, FIG. 2, element 215) using a

determined variance of multiple access interference (*see* FIGS. 3 and 4 and the written description thereof) and applying the normalization factor to the output of the receiver (*see* FIG. 2, element 220).

Independent claim 9 relates to a receiver. *See* FIG. 1, element 100 and the written description thereof. The receiver includes a detector to receive transmitted information and provides [sic] one or more output symbols based on the transmitted information (*see* FIG. 1, elements 110, 115) a metric correction section to normalize the one or more output symbols to obtain one or more metrics (*see* FIG. 1, element 120), and a channel decoder to receive the one or more metrics from the metric correction section (*see* FIG. 1, element 125). The normalization is based on a determined variance of multiple access interference. *See* FIGS. 3 and 4 and the written description thereof. The channel decoder utilizes the one or more metrics to decode the transmitted information. *See* FIG. 1, element 125.

Independent claim 24 relates to a method that includes receiving a symbol (*see* FIG. 1, element 110), determining a normalization factor for the symbol using a determined variance in a level of multiple access interference for the symbol (*see, e.g.*, FIG. 2, element 215, page 6, line 6-13), normalizing the

symbol with the normalization factor (*see* FIG. 2, element 220), and providing the normalized symbol to a channel decoder (*see* page 6, line 14-19).

(6) Grounds of Rejection

In the action mailed April 27, 2006, claims 1, 3-14, 16-18, 24, 25, 27, and 28 were rejected under 35 U.S.C § 103(a) as obvious over U.S. Patent Publication No. 2002/0181624A1 to Gonzalez et al. (hereinafter "Gonzalez"), U.S. Patent No. 6,754,251 to Sriram et al. (hereinafter "Sriram"), and the pages 21-22 of the publication entitled "Digital Communications: Fundamentals and Applications" by Bernard Sklar (hereinafter "Sklar").

The following ground for rejection presented for review on appeal is:

-The rejection of independent claims 1, 9, 24 under 35 U.S.C § 103(a) as obvious over Gonzalez, Sriram, and Sklar.

(7) Argument

Since Gonzalez, Sriram, and Sklar do not Disclose that the Variance of Multiple Access Interference should be Determined or Used as Claimed, the Obviousness Rejections of Claims 1, 9, and 24 should be Withdrawn

Claim 1, which is illustrative, relates to a method of normalizing an output of a receiver. The method includes

determining a normalization factor using a determined variance of multiple access interference and applying the normalization factor to the output of the receiver.

None of Gonzalez, Sriram, and Sklar describes or suggests applying a normalization factor that is determined using a determined variance of multiple access interference, as recited in claim 1.

In this regard, Sklar provides a mathematical definition of variance. In particular, Sklar describes that variance of a random variable is the difference between a mean-square value and the square of the mean of the random variable.

Applicant is at a loss to understand how the mathematical definition of variance has any relevance to the present obviousness rejection. The present rejection is based on the contention that it would have been obvious for one of ordinary skill to apply a normalization factor that is determined using a determined variance of multiple access interference, as recited in claim 1. The mathematical definition of variance does not describe or suggest that the variance of multiple access interference should be determined or applied in the manner claimed.

Gonzalez and Sriram share this deficiency with Sklar. Gonzalez uses a final channel estimate that is the linear combination of pilot-aided and data-aided channel estimates and the variances of those estimates. *See Gonzalez*, Eq. 10 and para. [0038]. This channel estimate is based on a generic variance of noise σ^2. *See Gonzalez*, para. [0031]-[0032]. Gonzalez indicates that this generic variance of noise σ^2 is to be determined using "well-known techniques." *See Gonzalez*, para. [0030]. Gonzalez is silent as to any contribution by multiple access interference to this generic noise and as to how the variance of any contribution by multiple access interference to this generic noise variance can be determined.

Please note that the characterizations of Gonzalez' generic variance of noise σ^2 as "*interference* variance" in the April 27, 2006 Office Action are baseless. Indeed, the word "interference" only appears once in Gonzalez and has nothing to do with the generic variance of noise σ^2 relied upon by the rejection. *See Gonzalez*, para [0009].

Further, Gonzalez describes that this generic variance of noise provides channel estimates that are both easy to generate and exhibit small variances. *See Gonzalez*, para. [0014]. The rejections have never established any basis why one of ordinary skill would depart from the easy and effective estimates

described by Gonzalez and based on the generic variance of noise to determine a variance of multiple access interference, as recited in claims 1, 19, 24.

Sriram fails to remedy these deficiencies of Gonzalez and Sklar. To begin with, Sriram also does not *determine* the variance of multiple access interference. Instead, Sriram describes that the output of his code scheme is to be simulated using a total variance N. *See Sriram*, col. 17, line 44 and col. 18, line 7-18. This total variance N is similar to Gonzalez' generic variance of noise σ^2 in that it represents the contributions of a variety of different noise sources. In particular, total variance N represent contributions from "thermal noise, inter- and intra-cell interference, and cross-correlation among different PN sequences, or their shifts." *See Sriram*, col. 18, line 16-19.

Simulating a total variance does not disclose or suggest determining a variance of one contributor to that total variance. As with Gonzalez, the variance of multiple access interference is lumped in with other sources of noise. There is no description or suggestion in Sriram that would lead one of ordinary skill away from including multiple access interference in with other sources to the recited determination of a variance of multiple access interference.

Since Sklar, Sriram, and Gonzalez neither describe nor suggest determining of a variance of multiple access interference or even that the determination of such a variance is desirable, a *prima facie* case of obviousness has not been established. The rejections of claims 1, 19, 24, and the claims dependent therefrom should therefore be withdrawn.

Each of the dependent claims should be allowable by virtue of their dependency, as well as on their own merits.

In view of the above, it is respectfully suggested that all of the claims should be in condition for allowance. A formal notice to that effect is respectfully solicited.

No fee is believed due at this time. If this is in error, or charges are due for any reason, please apply such fees or charges to Deposit Account No. 06-1050.

Respectfully submitted,

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(8) Claims Appendix

1. A method of normalizing an output of a receiver, the method comprising:

determining a normalization factor using a determined variance of multiple access interference; and

applying the normalization factor to the output of the receiver.

2. The method of Claim 1, wherein applying the normalization factor comprises normalizing each symbol output from the receiver with a normalization factor that is independent of normalization factors of previous symbols.

3. The method of Claim 1, further comprising obtaining a metric correction factor using the normalization factor.

4. The method of Claim 3, further comprising providing the metric correction factor to a channel decoder.

5. The method of Claim 1, wherein determining the normalization factor comprises determining a log likelihood ratio (LLR) according to the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_{\mathrm{T}}^{2}(n)}$$

where:

r(n) is the detector output of the n^{th} symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_T^2(n)$ is the total noise variance.

6. The method of Claim 5, further comprising determining the variance of multiple access interference analytically.

7. The method of Claim 5, further comprising determining the variance of multiple access interference empirically.

8. The method of Claim 1, further comprising employing multiuser detection to obtain the output of the receiver.

9. A receiver comprising:

a detector to receive transmitted information and provides one or more output symbols based on the transmitted information;

a metric correction section to normalize the one or more output symbols to obtain one or more metrics, the normalization based on a determined variance of multiple access interference; and

a channel decoder to receive the one or more metrics from the metric correction section, the channel decoder to utilize the one or more metrics to decode the transmitted information.

10. The receiver of Claim 9, wherein the detector comprises a multiuser detector.

11. The receiver of Claim 9, wherein the detector comprises a rake detector.

12. The receiver of Claim 9, wherein the metric is based on a log likelihood ratio.

13. The receiver of Claim 9, wherein the metric correction section determines one or more normalization factors to apply to the one or more output symbols of the detector.

14. The receiver of Claim 9, wherein the detector comprises a long code CDMA detector.

15. The receiver of Claim 14, wherein the metric correction section is to normalize each output symbol on a symbol by symbol basis with a normalization factor that is independent of the normalization factors of previous symbols.

16. The receiver of Claim 9, wherein the metric is based on a log likelihood ratio for BPSK signaling that is determined from the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_T^2(n)}$$

where:

r(n) is the detector output of the n^{th} symbol;

g(n) is the time varying gain associated with the desired

symbol; and

$\sigma_{\mathrm{T}}^2(n)$ is the total noise variance.

17. The receiver of Claim 16, wherein the variance of the multiple access interference is determined analytically.

18. The receiver of Claim 16, wherein the variance of the multiple access interference is determined empirically.

19. A method comprising:

receiving one or more output symbols from a detector;

determining a normalization factor for each of the one or more output symbols, each normalization factor being independent of normalization factors for previous output symbols;

multiplying each of the one or more output symbols by the corresponding normalization factor to obtain a metric correction; and

providing the metric correction for each symbol to a channel decoder.

20. The method of Claim 19, further comprising decoding a transmission using the metric correction.

21. The method of Claim 19, further comprising determining the normalization factor based on the following equation:

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_{\mathrm{T}}^2(n)}$$

where:

r(n) is the detector output of the n^{th} symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_{\mathrm{T}}^2(n)$ is the total noise variance.

22. The method of Claim 21, further comprising determining a variance of a level of multiple access interference analytically.

23. The method of Claim 21, further comprising determining a variance of a level of multiple access interference empirically.

24. A method comprising:

receiving a symbol;

determining a normalization factor for the symbol using a determined variance in a level of multiple access interference for the symbol;

normalizing the symbol with the normalization factor; and

providing the normalized symbol to a channel decoder.

25. The method of claim 24, wherein determining the normalization factor comprises:

determining a time varying gain associated with a desired symbol; and

determining the variance in the level of multiple access interference for the symbol.

26. The method of claim 25, wherein determining the normalization factor further comprises determining the variance in a noise term that is independent of the variance in the level of multiple access interference.

27. The method of claim 24, wherein normalizing the symbol with the normalization factor comprises multiplying the symbol by a log likelihood ratio.

28. The method of claim 27, wherein multiplying the symbol by the log likelihood ratio comprises multiplying the symbol by

$$LLR(n) = -\frac{2r(n)g(n)}{\sigma_{\mathrm{T}}^2(n)}$$

where:

r(n) is an output of the symbol;

g(n) is the time varying gain associated with the desired symbol; and

$\sigma_{\mathrm{T}}^2(n)$ is the total noise variance.

(9) Evidence Appendix

None.

(10) Related Proceedings Appendix

None.